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PUBLIC HEALTH REPORTS

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SWITZERLAND HARD HIT BY INFLUENZA.

Official reports just received from Switzerland show that the pandemic of influenza affected about 700,000 out of that country's population of 4,000,000. This is 17.5 per cent. The sudden rise of the pandemic is well shown by the following monthly totals of cases reported during 1918:

January	2	July	53,698
February	4	August	41,626
March	6	September	41,642
April	13	October	263,399
May	3	November	159,422
June	6	December	104,612

Here we see again, as was the case in England,[1] two distinct waves; one with its crest in July, the other with the crest in October. The occurrence of these waves in practically all parts of the world where the pandemic prevailed is most puzzling. It is difficult to conceive of any external, i. e., environmental, influence acting so uniformly throughout the world, and that the virus should everywhere show these peculiar variations in infectivity and virulence is certainly most remarkable.

THE NEW SCIENCE OF INDUSTRIAL PHYSIOLOGY.

By FREDERIC S. LEE, Ph. D., LL. D., Professor of Physiology in Columbia University; Consulting Physiologist to the United States Public Health Service; Chairman of the Committee on Fatigue in Industrial Pursuits of the National Research Council.

In surveying the extraordinary growth of industry during recent decades one can not fail to be struck by its many-sided aspects, the diversity of its problems, and the variety of human intellects that have been called upon to solve the problems. Industry is not simply an affair of employer and employee; it has its manufacturing aspects, its economic aspects, its engineering aspects, its medical aspects, its chemical aspects, its human aspects, and its efficiency aspects. Quite recently its aspects of efficiency have risen into great prominence, and it has come to be recognized by all concerned that industrial success is dependent in large measure on the efficiency of the labor element. What has been called scientific management and efficiency engineering has accomplished something in promoting industrial efficiency—this must be acknowledged even by its opponents—but a critical analysis of the conventional scientific management reveals its shortcomings and its inability to go very far in eliminating the great problem of inefficiency.

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[1] Public Health Reports, Apr. 4, 1919, pp. 683 and 684.

The fact must be recognized that in the body of the worker, with its combination of living organs and tissues, undergoing chemical reactions and transforming energy under the direction of a nervous system, we have a very intricate mechanism, upon the proper working of which depend in large degree industrial efficiency and, through it, industrial success. This fact began to be perceived many years ago through the publication of various isolated studies and finally of Miss Goldmark's prophetic "Fatigue and Efficiency." But the the period of the war, with its extraordinary call upon human energies in the field of industry, has emphasized as never before the hygienic, or more properly speaking, the physiological aspects of industrial activity, and during the past four years the beginnings of a new science, an industrial physiology, have appeared and attracted the attention of scientific men and the more sagacious of industrial leaders.

I have called this new science "Industrial physiology," because this term seems to me to be the most appropriate single term to use in discussing this new phase of the application of scientific method to the solution of human problems. By it I mean to designate the sum of knowledge pertaining to the working of the human mechanism in industrial activity, and it thus includes psychological phenomena as well as those more technically recognized as physiological.

Industrial physiology has two objects: First, the more purely scientific one of learning how the industrial worker actually performs his work and what the conditions are under which he can work most efficiently and can produce the largest output while at the same time maintaining his body in health and in the best working condition; and secondly, the more practical object of establishing in the factories the conditions which conduce at the same time to the maximum output and the maintenance of the maximum power of the worker. The former of these two objects is now being achieved; the latter will be achieved when it becomes clear to both employers and workers that it is to the advantage of both that industrial work be organized on a really intelligent basis and not, as heretofore, on a basis of ignorance of how the worker can do his best.

The methods by which industrial physiology is being developed are the recognized methods of all scientific investigation, namely, observation and experiment. The investigations are carried on chiefly in the factories, the workers being used as the subjects and under their actual working conditions, these conditions being changed when it is desired to compare the efficiency of one set of conditions with that of another. Exact measurements of output are made, and, where it is possible, exact tests of the physiological effects of the work are employed. Every effort is made to procure exact data and utilize these as a basis for forming conclusions, rather than to rely upon mere opinion and preconceived notions.

Some of the topics that have been or are being investigated, and some of the results, are the following:

Certain physiological and psychological tests have been employed with workers, and it appears practicable to employ some of these tests in selecting workers and assigning them to their jobs.

The output of the successive hours of the working day in different types of operations has been measured, and the daily curves of the output have been plotted. These vary with the kind of operation, but are alike in showing a reduced efficiency, indicating a growing fatigue, as the day proceeds.

Reduction in the length of the working day is characterized by an increase in the output of the successive hours and usually by a total increase in that of the day. The optimum duration of work probably varies with the character of the work itself.

The introduction of resting periods in the working spell is accompanied, especially where the working day is long, by a total increase in the day's production. A five-hour working spell, unbroken by resting periods, is probably always too long.

Overtime following a day of labor is inadvisable, as is also Sunday work following a week's labor. These tend to impair the working power of the worker.

A hot day tends to impair strength and reduce output. Every effort should be made to keep the body of the worker cool.

Night work is, in general, less efficient than day work. Its total output is less, and this, with a long working night, falls off enormously in the early morning hours. Alternation of periods of night work with periods of day work is more profitable than continuous night work.

Women are capable of performing a much greater variety of industrial operations than has heretofore been recognized. They should not be employed for night work. Statistics show that they are absent from their work more frequently than men. The problem of women as compared with men in industry is not that of their greater or less general efficiency, but rather a problem of what types of work each sex is best fitted for.

Accidents to workers are a grave source of inefficiency. They are caused by fatigue, inexperience, speed of working, insufficient lighting, high temperature, and other factors. Many industrial accidents are preventable, and adequate provisions for first-aid measures tend to diminish the seriousness of accidents.

Food and efficiency are directly connected with one another, and suitable and adequate food can probably be best provided through the establishment of industrial canteens.

A high labor turnover is incompatible with the highest degree of efficiency. It is expensive, in that it imposes upon the employer the necessity of training new workers, and it is a serious factor in the causation of accidents.

Physiological analyses of certain operations have been made, by means of the cinematograph and other methods, and it has been found possible to eliminate unnecessary motions and to train workers so as to secure a more regular rhythm, such measures increasing efficiency.

The self-limitation of work on the part of workers has been studied and found to be very common. Every legitimate effort should be employed by foremen and managers to eliminate this and to induce workers to work up to their physiological capacity. Driving workers beyond their physiological capacity defeats its own ends.

Such topics as the above and others likewise bearing on efficiency have been studied extensively during the past three years in both England and America. In England the Health of Munition Workers Committee carried on a series of investigations from 1915 to 1918, and have published their data in a series of 23 valuable reports. The circulation of these reports has been large, over 210,000 copies being distributed, and the committee's recommendations have been widely accepted. The committee has now ceased to exist, but its investigations are being continued actively by a new body, the Industrial Fatigue Research Board, which has been appointed jointly by the Department of Scientific and Industrial Research and the Medical Research Committee. The functions of this new board are "to consider and investigate the relations of the hours of labor and other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers." The board has as its chairman Prof. Sherrington, F.R.S., of Oxford, and its members comprise such well-known men as Sir Walter Fletcher, F.R.S., secretary of the Medical Research Committee; Col. Myers, F.R.S., director of the psychological laboratory of Cambridge; Dr. Collis, head of the welfare and health section of the ministry of munitions;

Dr. Legge, of the Home Office; representatives of two of the leading industrial establishments of England; and others. The board has formulated an ambitious and far-reaching plan for its future investigations, and is considering a suggestion to send soon to America several representatives to inspect the leading factories, to study the conditions of labor, and to learn what is being done here in the direction of placing industry on a more scientific basis.

In America during the past 18 months the Public Health Service, with the cooperation of the committees on fatigue in industrial pursuits and on industrial fatigue, of the National Research Council and the Council of National Defense, respectively, has been conducting a fruitful investigation of a variety of topics within the scope of industrial physiology, and its report will soon be ready for publication.

During a recent visit to England and France in the interests of the Public Health Service the writer was privileged to confer with the members of the Industrial Fatigue Research Board and to take part in its deliberations. He was much impressed with the highly scientific character of the board's work and aims, and the earnestness of its determination to make a broad and searching study of the physiological aspects of industrial work. He was able to establish relations of intimate and cordial cooperation between the board and the United States Public Health Service. In France a similar sympathetic spirit of international amity was found among several of the leading scientific men, and it is probable that a center for a similar type of scientific investigation will soon be established there. The Marey Institute of Paris, under the directorship of Prof. Richet and the subdirectorship of Dr. Bull, had already outlined such a research just before the war put a stop to the realization of the institute's plans and turned its activities into other urgent war channels.

While this work is thus progressing in the three countries that are of leading industrial importance the universities are not inactive. In England, Prof. Stanley Kent, who has been carrying on an independent investigation of some phases of industrial fatigue during the past three years, has been called from his chair of physiology in Bristol to become the director of a new Department of Industrial Administration in the Municipal Technical College of Victoria University, Manchester. In this position he will find a rich field for research in the important industrial establishments situated in Manchester and vicinity. In our own country, Harvard University, through the foresight and generosity of a group of manufacturers, has been enabled to establish courses of instruction and opportunities for investigation in the medical, physiological, and sanitary aspects of industry; and similar activities are expected from the School of Hygiene and Public Health recently established in Johns Hopkins University.

With the ending of the war the problems of industry press for solution more earnestly than ever, and one of the most timely of these problems concerns the physiological aspects of the work of the human machine. Upon us in America, where industry is destined to lead the world, there is imposed a grave duty—that of directing investigation along such lines that empiricism and tradition, those two obstacles to progress which have long been potent in industrial evolution, shall be cast out and industry shall be placed permanently upon a scientific basis.

REST PERIODS FOR INDUSTRIAL WORKERS.

Written as it is from the standpoint of the manufacturer, and considering mainly, therefore, questions of output, of administration, and of labor turn-over, the report just issued by the National Industrial Conference Board, entitled "Rest Periods for Industrial Workers," constitutes an interesting addition to the literature on rest periods and fatigue.[1]

The report published by the National Industrial Conference Board is based on a study carried on chiefly by means of a schedule of inquiry sent to 388 employers reported to have made experiments with rest periods. Of these, 104 reported that they had tried regular rest periods; 129 stated that they had made no experiments with rest periods; and no replies were received from the remaining 155 establishments, presumably in most instances because they had no experience to report.

Following are the principal conclusions expressed in the board's report:

"From the evidence presented it is obvious that all workers require pauses for rest or relaxation through change of position, but in many occupations the nature of the work itself allows such relief. A decision whether fixed rest periods will be more beneficial than unregulated pauses is best reached after a plant survey and time study of each occupation. The tendency to allow rest periods to women, even though they may not be granted to men, is a precaution on the safe side, but the type of work is a more fundamental consideration than the sex of the worker. Rest periods may be advantageous for both men and women in some occupations, while unnecessary for both in others.

"The experience assembled in this report indicates that rest periods have been found especially advantageous for workers on repetitive tasks demanding constant and close application. Hence the tendency of modern manufacturing to greater standardization and the increased use of automatic machinery make the problem of regular rest periods one of increasing significance to employers. Regular rest pauses based on experimental observation have also proved

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[1] Research Report No. 13, published by the National Industrial Conference Board, 15 Beacon Street, Boston, Mass.